Studies of the 32-channel TOF-PET detector prototype
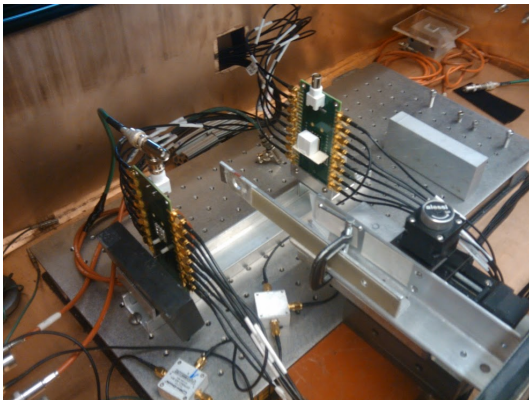
Correlated Effects in the Test System Readout

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April 5, 2012

Setup

- use new LYSO crystal arrays with 4x4 Hamamatsu 11064 MPPC arrays
- ^{22}Na source (not shown)
- trigger on coincidences of the channels 13 and 21
- V(MPPC) = -77V , the same on both arrays
- currents very similar: 480mkA and 474 mkA

Introduction

- V1742 calibrated, "per-cell" pedestal subtraction works
- resulting noise RMS < 1mV
- pulse charge $Q = \Sigma V_i / 10$
- expect small charge in empty channels, this, however, depends on the pedestal subtraction
- pedestal shifts –> large |Q|
- below: a trivial event display, showing charges in the two 4x4 crystal arrays
- left 4x4 channels: the first array, right 4x4 channels: the second array
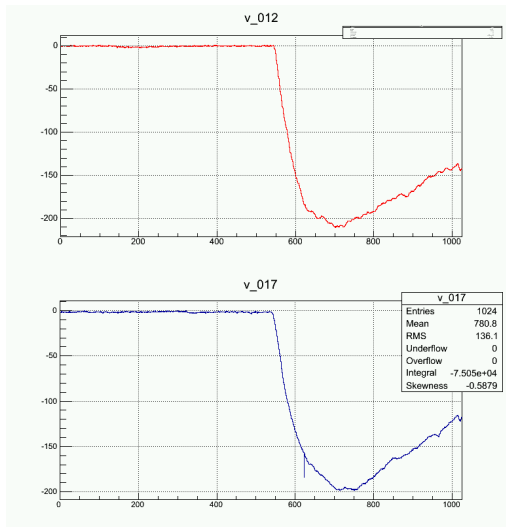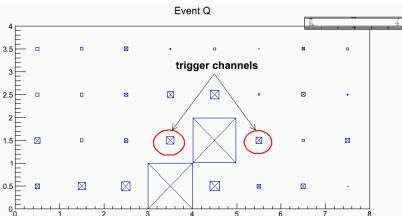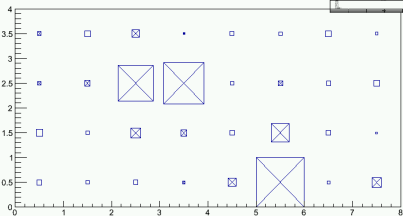

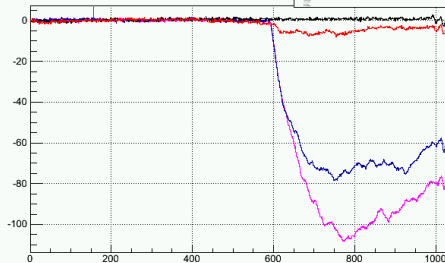
- pulses in the two highest channels

An Example of a "Normal" Event

- so far: calculate and subtract average pedestals
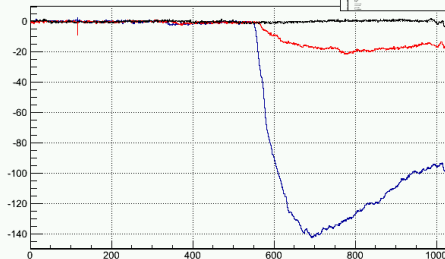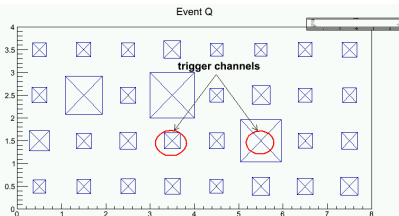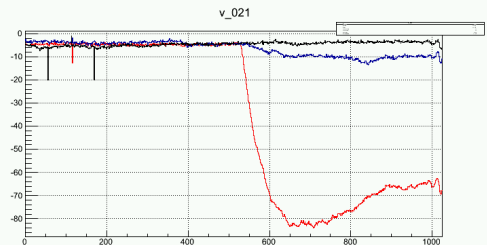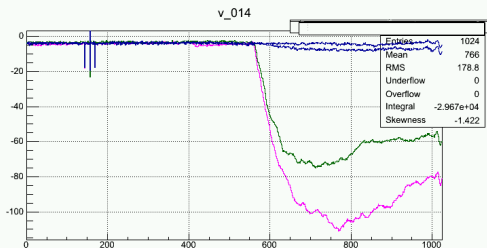- shown event: result of subtraction is consistent with zero

Correlated shifts of the pedestals

- observe events with the zero voltage level shifted wrt zero
- the shift is correlated across the channels

Event Q

- to account for this effect, need to fit pedestals on event-by-event basis in each channel using cells prior to the pulse

v_014

Entries	1024
Mean	766
RMS	178.8
Underflow	0
Overflow	0
Integral	-2.967e+04
Skewness	-1.422

v_021

- pulses in several channels

Summary

- amplitude calibrations look good, remaining noise RMS < 1 mV
- pulses are good, S/N > 100
- observe pedestal shifts correlated across the channels
- need to fit pedestals on event-by-event basis
- currently, T0 $\sim$ 500 channels, need to reduce the trigger delay
- want to leave $\sim$ 100 channels (20ns) for fitting the pedestal
- with the current signals, it is sufficient to digitize and read out 400 channels = 80ns